

What is claimed is:

- 1 1. An integrated circuit comprising:
2 a parallel frame delineation module having a plurality of concurrent
3 comparators to delineate received frame boundaries within a Universal Serial Bus
4 (USB) peripheral non-return to zero invert (NRZI) data stream; and
5 an NRZI decoder module to decode received NRZI encoded data using
6 parallel data processing.
- 1 2. The integrated circuit of claim 1, wherein the USB peripheral NRZI data
2 stream follows a protocol defined in version 2.0 of the USB specification.
- 1 3. The integrated circuit of claim 2, wherein the parallel frame boundary
2 delineation module comprises a three-stage pipeline.
- 1 4. The integrated circuit of claim 3, further comprising a pipeline control state
2 machine.
- 1 5. The integrated circuit of claim 3, wherein the parallel frame boundary
2 delineation module further comprises a parallel start-of-packet detector.
- 1 6. The integrated circuit of claim 5 wherein the parallel start-of-packet detector
2 comprises eleven concurrent comparators.
- 1 7. An apparatus comprising:
2 one or more Universal Serial Bus (USB) connectors to couple to a
3 communications channel carrying a USB data stream;
4 an application specific integrated circuit comprising a USB transceiver, a
5 serial interface engine and apparatus-specific logic, the USB transceiver having
6 concurrent comparators to delineate received asynchronous frame boundaries within
7 the USB data stream and parallel logic to decode received encoded data.

1 8. The apparatus of claim 7, wherein the apparatus-specific logic comprises
 2 logic for an apparatus selected from the group consisting of: a hub, a digital camera,
 3 a video-conferencing camera, a printer, a keyboard, a scanner, a modem, a digital
 4 phone, a removable media drive, a CD/DVD drive, a gaming device, a hard drive, a
 5 mouse, a trackball, a pointer, a display device, a speaker and a networking device.

1 9. The apparatus of claim 7, wherein the parallel logic decodes non-return to
 2 zero invert (NRZI) encoded data.

1 10. A method of delineating asynchronous frame boundaries in a Universal
 2 Serial Bus (USB) data stream, the method comprising:
 3 receiving a USB data stream;
 4 searching for a frame delineation marker in the data received using
 5 concurrent comparators;
 6 asserting a flag upon detection of the frame delineation marker; and
 7 creating a vector indicating a location of a frame boundary in the data
 8 stream.

1 11. The method of claim 10, wherein the USB data stream comprises non-return
 2 to zero invert (NRZI) data.

1 12. The method of claim 11, wherein the NRZI data is received in nine-bit
 2 fields.

1 13. The method of claim 10, wherein the act of searching for a frame delineation
 2 marker is performed concurrently on a twenty-seven bit field of data.

1 14. The method of claim 13, wherein the frame delineation marker comprises
 2 "00101010".

10041343 102401
104201 243400

1 15. The method of claim 10, wherein the act of searching is performed by eleven
2 concurrent comparators.

1 16. The method of claim 10, wherein the vector created comprises an eleven-bit
2 vector.

1 17. An integrated circuit comprising:
2 a three-stage pipeline to receive consecutive nine-bit fields of data from an
3 incoming Universal Serial Bus (USB) data stream; and
4 a parallel start-of-packet detector having concurrent comparators to identify
5 a frame delineation marker in the incoming USB data stream.

1 18. The integrated circuit of claim 17, further comprising a non-return to zero
2 invert (NRZI) data decoder to decode the incoming USB data stream.

1 19. The integrated circuit of claim 18, further comprising a state machine to
2 determine when the incoming USB data stream contains valid data.